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Thermal decoupling in dark matter models with Sommerfeld-enhanced annihilation rates

The expansion of the Universe causes DM annihilations to cease at chemical decoupling, but the DM is still kept in thermal equilibrium until kinetic decoupling. The temperature T_{kd} at which this happens translates directly into a small-scale cutoff for the matter density fluctuations. After kinetic decoupling the WIMP temperature decreases more quickly than the heat bath temperature, which causes the DM to reenter an era of annihilation if the cross-section is enhanced by the Sommerfeld effect. This can influence the final relic abundance of the DM signifcantly. Important for this discussion is the velocity distribution of the WIMPs, which can be kept Maxwellian by DM self-scatterings, and the temperature at which the annihilations finally cease, either by matter domination or the saturation of the Sommerfeld factor. The temperatures at which these effects take place, and the total effect on the final relic density are estimated for a leptophilic model and an estimate for the cutoff mass M_{cutoff} for the first protohalos will be given in this talk.

Primary author: Ms VAN DEN AARSSEN, Laura (Universität Hamburg)

Co-authors: Dr BRINGMANN, Torsten (Universität Hamburg); Mr GÖDECKE, Yaşar (Universität Hamburg)

Presenter: Ms VAN DEN AARSSEN, Laura (Universität Hamburg)